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Claims

[c1] A method for protecting epithelial tissue during photodynamic therapy induced using a pre-photosensitizing agent, the method comprising the steps of:
administering a pre-photosensitizing agent to a targeted treatment site;
preventing metabolism of the pre-photosensitizing agent in epithelial tissue surrounding the targeted treatment site, while allowing the pre-photosensitizing agent to metabolize into a photosensitizing agent in tissue at the targeted treatment site; and
irradiating the treatment site to activate the photosensitizing agent at the targeted treatment site, wherein the epithelial tissue surrounding the targeted treatment site is substantially unaffected.

[c2] The method of claim 1, wherein the step of preventing metabolism of the pre-photosensitizing agent in epithelial tissue surrounding the targeted treatment site comprises creating a temperature gradient between the epithelial tissue and tissue at the targeted treatment site.

[c3] The method of claim 2, wherein the temperature gradient is created before the step of irradiating.

[c4] The method of claim 2, wherein the temperature gradient is created by cooling the epithelial tissue surrounding the targeted treatment site.

[c5] The method of claim 4, wherein the step of cooling comprises the step of positioning a contact device containing a cooling medium on the epithelial tissue.

[c6] The method of claim 5, wherein the cooling medium is selected from the group consisting of a solid, liquid, and a gas medium.

[c7] The method of claim 5, wherein the contact device further includes a radiant energy source that is effective to heat tissue at the targeted treatment site.

[c8] The method of claim 7, wherein at least a portion of the contact device is transparent for allowing radiant energy from the radiant energy source to pass therethrough.

[c9] The method of claim 5, wherein the contact device is removed from the epithelial tissue before the targeted treatment site is irradiated with light.

[c10] The method of claim 5, wherein the contact device is coupled to a light source for irradiating the targeted treatment site.

[c11] The method of claim 4, wherein the epithelial tissue is cooled concurrently while the targeted treatment site is irradiated with light.

[c12] The method of claim 4, wherein the epithelial tissue is cooled to a temperature that differs from a temperature of tissue at the targeted treatment site by at least about 5° C.

[c13] The method of claim 4, wherein the epithelial tissue is cooled to a temperature that is equal to or less than about 25° C.

[c14] The method of claim 4, wherein the epithelial tissue is cooled to a temperature in the range of about 20° C to -5° C.

[c15] The method of claim 2, wherein the temperature gradient is created by cooling the epithelial tissue surrounding the targeted treatment site and heating tissue at the targeted treatment site.

[c16] The method of claim 15, wherein the tissue at the targeted treatment site is heated to a temperature that is equal to or greater than about 25° C.

[c17] The method of claim 15, wherein the tissue at the targeted treatment site is heated to a temperature in the

range of about 25° C to 40° C.

[c18] The method of claim 15, wherein the step of heating the tissue at the targeted treatment site comprises delivering a radiant energy source to the tissue.

[c19] The method of claim 18, wherein the radiant energy source is selected from the group consisting of visible light, infrared light, microwave energy, ultrasound, and radiofrequency energy.

[c20] The method of claim 1, wherein the targeted treatment site comprises malignant cells, and the step of irradiating the targeted treatment site with light is effective to substantially destroy the malignant cells.

[c21] The method of claim 1, wherein the targeted treatment site comprises a patient's sebaceous glands, and the step of irradiating the targeted treatment site with light is effective to treat acne.

[c22] The method of claim 1, wherein the targeted treatment site comprises a patient's hair follicles, and the step of irradiating the targeted treatment site with light is effective to substantially remove hair associated with the hair follicles.

[c23] The method of claim 1, wherein the step preventing

metabolism of the pre-photosensitizing agent in epithelial tissue surrounding the targeted treatment site comprises applying a chemical inhibitor to epithelial tissue surrounding the targeted treatment site.

[c24] The method of claim 23, wherein the chemical inhibitor is applied to the epithelial tissue at a concentration that is equal to or greater than about 0.1%.

[c25] The method of claim 23, wherein the chemical inhibitor is selected from the group consisting of 4-dioxoheptanoic acid, succinyl acetone, pridoxal-5-phosphate, zinc ions, ferrous ions, and lead ions.

[c26] The method of claim 23, wherein the chemical inhibitor is applied to the epithelial tissue for a duration of at least about 15 minutes.

[c27] The method of claim 23, wherein the chemical inhibitor is in a cream that is applied to the epithelial tissue.

[c28] The method of claim 27, wherein the pre-photosensitizing agent is contained within the cream and applied simultaneously with the chemical inhibitor.

[c29] The method of claim 23, wherein the pre-photosensitizing agent is applied to the targeted treatment site after the chemical inhibitor is applied to the

epithelial tissue.

[c30] The method of claim 23, further comprising the step of cooling the epithelial tissue before irradiating the treatment site with light.

[c31] The method of claim 23, wherein the pre-photosensitizing agent is porphyrin precursor.

[c32] The method of claim 23, wherein the pre-photosensitizing agent is an enzyme-activated pre-photosensitizer construct.

[c33] The method of claim 23, wherein the pre-photosensitizing agent comprises aminolevulinic acid (ALA).

[c34] The method of claim 33, wherein the ALA is applied at a concentration of at least about 0.1%.

[c35] A device for protecting non-targeted epithelial tissue during photodynamic therapy induced using a photosensitizing agent, the device comprising:
a tissue-contacting member adapted to cool non-targeted epithelial tissue, at least a portion of the tissue-contacting member being transparent to allow a radiant energy to pass therethrough; and
a radiant energy source coupled to the tissue-contacting

member for heating tissue at a targeted treatment site underlying non-targeted epithelial tissue.

[c36] The device of claim 35, further comprising a light source coupled to the tissue-contacting member and effective to deliver irradiating light through the tissue-contacting member to a targeted treatment site.

[c37] The device of claim 35, wherein the tissue-contacting member is coupled to a cooling medium that is effective to cool tissue in contact with the tissue-contacting member.

[c38] The device of claim 37, wherein the cooling medium is selected from the group consisting of a solid, liquid, and a gas medium.

[c39] The device of claim 35, further comprising at least one temperature controller adapted to regulate the radiant energy source and the tissue-contacting member.

[c40] The device of claim 35, wherein the tissue-contacting member is in the form of a disposable patch.

[c41] A composition for use during photodynamic therapy induced using a photosensitizing agent, the composition comprising:
a cream containing a chemical inhibitor that is effective

to prevent conversion of a photosensitizing agent into a phototoxic species.

[c42] The composition of claim 40, wherein the chemical inhibitor comprises 4-dioxoheptanoic acid, succinyl acetone, pridoxal-5-phosphate, zinc ions, ferrous ions, and lead ions.

[c43] The composition of claim 40, wherein the cream further contains a pre-photosensitizing agent.